CLAIMS

1. An integrated heater comprising:

a semiconductor material;

at least one transistor formed in the semiconductor material and operable to generate heat above a selected threshold; and

an object to be heated positioned adjacent to the transistor to receive the heat generated by the transistor.

2. The integrated heater of claim 1 wherein the object to be heated is a fluid chamber positioned adjacent to the semiconductor material.

3. The integrated heater of claim 1 wherein the object to be heated is a fluid chamber formed in the semiconductor material.

4. The integrated heater of claim 1 wherein the semiconductor material has a wall portion adjacent to the transistor to transmit heat generated by the transistor through the semiconductor wall portion, and further including a body having wall portion positioned adjacent to and in sealing engagement with the semiconductor wall portion, such that the semiconductor wall portion and the body wall portion together define a fluid chamber as the object to be heated.

5. The integrated heater of claim 4, further including a dielectric layer extending over the semiconductor wall portion and facing toward the fluid chamber.

6. The integrated heater of claim 1, further including a thermally insulating barrier formed in the semiconductor material extending about the transistor to limit transmission in the semiconductor material of the heat generated by the transistor beyond the insulating barrier.

7. The integrated heater of claim 1 wherein the semiconductor material extends laterally beyond the transistor to provide a lateral semiconductor portion, and the object to be heated is positioned laterally adjacent to the transistor and adjacent to the lateral semiconductor portion to receive the heat generated by the transistor which is transmitted laterally to the lateral semiconductor portion.

8. The integrated heater of claim 7, further including a dielectric layer extending over the semiconductor material with a window formed in a portion of the dielectric layer at a location adjacent to the lateral semiconductor portion, and wherein the object to be heated is positioned at the window to receive the heat generated by the transistor which passes through the window.

9. The integrated heater of claim 7 wherein the object to be heated is a fluid chamber.

10. The integrated heater of claim 7 wherein the lateral semiconductor portion has a wall portion to transmit heat to the object to be heated that is generated by the transistor and transmitted through the lateral semiconductor portion, and further including a body having a wall portion positioned adjacent to and in sealing engagement with the lateral semiconductor wall portion, such that the lateral semiconductor wall portion and the body wall portion together define a fluid chamber as the object to be heated.

11. The integrated heater of claim 7, further including a thermally insulating barrier formed in the semiconductor material extending laterally outward of and about the transistor and the lateral semiconductor portion to limit transmission in the semiconductor material of the heat generated by the transistor laterally beyond the insulating barrier.

12. The integrated heater of claim 7, further including has a dielectric layer extending over a first face of the semiconductor material and a window formed in a portion of the

dielectric layer over the lateral semiconductor portion, with the object to be heated positioned at the window to receive the heat generated by the transistor which passes through the window, and further including a thermally insulating barrier formed in the semiconductor material extending laterally outward of and about the transistor and the window to limit transmission in the semiconductor material of the heat generated by the transistor laterally beyond the insulating barrier.

13. The integrated heater of claim 12, further including a thermally insulating layer extending over a second face of the semiconductor material opposite the first face, and the insulating barrier is positioned between the dielectric layer and the insulating layer.

14. The integrated heater of claim 12 wherein the object to be heated is a fluid chamber.

15. The integrated heater of claim 12, further including a body having wall portion positioned adjacent to and in sealing engagement with the dielectric layer about the window, such that the body wall portion defines a fluid chamber as the object to be heated with the heat being supplied thereto through the window.

16. The integrated heater of claim 1, further including a dielectric layer extending over a first face of the semiconductor material with the object to be heated positioned adjacent to the dielectric layer on a side thereof opposite the transistor to receive the heat generated by the transistor.

17. The integrated heater of claim 16, further including a thermally insulating barrier formed in the semiconductor material to define a portion of the semiconductor material inward to the insulating barrier positioned to receive the heat generated by the transistor, the insulating barrier being of a material which limits transmission of the heat generated by the

transistor and received by the inward portion of the semiconductor material beyond the insulating barrier.

18. The integrated heater of claim 16, further including a thermally insulating layer extending over a second face of the semiconductor material opposite the first face.

19. The integrated heater of claim 16, further including a body having a wall portion positioned adjacent to and in sealing engagement with the dielectric layer, such that the dielectric layer and the body wall portion together define a fluid chamber as the object to be heated.

20. The integrated heater of claim 1 wherein the object to be heated is a fluid.

21. An integrated heater comprising:

a semiconductor material;

a plurality of transistors formed in the semiconductor material and selectively operable to generate heat; and

an object to be heated positioned adjacent to the transistors to receive the heat generated by the transistors.

22. The integrated heater of claim 21 wherein the object to be heated is a fluid chamber positioned adjacent to the semiconductor material.

23. The integrated heater of claim 21, further including a thermally insulating barrier formed in the semiconductor material extending a perimeter about the transistors to limit transmission of the heat generated by the transistors beyond the insulating barrier.

24. An integrated heater comprising:

a semiconductor substrate;

a source region disposed in the semiconductor substrate;

a drain region disposed in the semiconductor substrate;

a channel region disposed in the semiconductor substrate between the source and drain regions to conduct electric current between the source and drain regions, the channel region having a resistance when conducting current to generate heat above a selected threshold;

a dielectric layer disposed on the channel region;

a gate electrode disposed on the dielectric layer to control the current conducted by the channel region; and

an object to be heated positioned to receive the heat generated by the resistance of the channel region.

25. The integrated heater of claim 24 wherein the object to be heated is a fluid chamber positioned adjacent to the semiconductor material.

26. The integrated heater of claim 24 wherein the object to be heated is a fluid chamber formed in the semiconductor substrate.

27. The integrated heater of claim 24, further including a thermally insulating barrier formed in the semiconductor substrate and extending at least partially about the channel region to define a portion of the semiconductor substrate inward to the insulating barrier positioned to receive the heat generated by the resistance of the channel region.

28. The integrated heater of claim 24 wherein the semiconductor substrate has a wall portion adjacent to the channel region to transmit the heat generated by the resistance of the channel region through the semiconductor wall portion, and further including a body having a wall portion positioned adjacent to the semiconductor wall portion and defining a fluid chamber as the object to be heated.

29. The integrated heater of claim 28, further including a heat transmitting dielectric layer positioned between the semiconductor wall portion and the body wall portion.

30. The integrated heater of claim 24, further including a body having a wall portion positioned adjacent to the dielectric layer and defining a fluid chamber as the object to be heated.

31. The integrated heater of claim 24, further including a thermally insulating layer positioned toward a side of the semiconductor substrate away from the dielectric layer.

32. The integrated heater of claim 31, further including a thermally insulating barrier formed in the semiconductor substrate to define an inward portion of the semiconductor substrate inward of the insulating barrier and positioned to receive the heat generated by the resistance of the channel region, the insulating barrier being of a material which limits transmission of the heat generated by the resistance of the channel region and received by the inward portion of the semiconductor material beyond the insulating barrier, the object to be heated being in thermal communication with the inward portion of the semiconductor material.

33. The integrated heater of claim 32 wherein the insulating barrier projects substantially fully between the dielectric layer and the insulating layer.

34. The integrated heater of claim 24, further including an overlay dielectric layer overlaying the gate electrode, the object to be heated being positioned adjacent to the overlay dielectric layer.

35. The integrated heater of claim 34, further including a body having a wall portion positioned adjacent to the overlay dielectric layer, across from the gate electrode, and defining a fluid chamber as the object to be heated.

36. The integrated heater of claim 35, further including a thermally insulating barrier formed in the semiconductor substrate and extending at least partially about the channel region to define a portion of the semiconductor substrate inward of the insulating barrier and adjacent to the fluid chamber such that the inward portion of the semiconductor substrate is in thermal communication with the fluid chamber.

37. The integrated heater of claim 36, further including a thermally insulating layer positioned toward a side of the semiconductor substrate away from the dielectric layer.

38. The integrated heater of claim 37 wherein the insulating barrier projects substantially fully between the dielectric layer and the insulating layer.

39. The integrated heater of claim 24 wherein the semiconductor substrate extends laterally beyond the source and drain regions to provide a lateral semiconductor substrate portion, and the object to be heated is positioned adjacent to the lateral semiconductor substrate portion to receive the heat generated by the resistance of the channel region which is transmitted laterally thereto through the lateral semiconductor substrate portion.

40. The integrated heater of claim 39, wherein the dielectric layer extends laterally over the lateral semiconductor substrate portion, and further including an overlay dielectric layer overlaying the gate electrode and a window formed in of the overlay dielectric layer at a location corresponding to the lateral semiconductor substrate portion, and wherein the object to be heated is positioned at the window to receive the heat transmitted laterally through the lateral semiconductor substrate portion generated by the resistance of the channel region and which passes through the window.

41. The integrated heater of claim 40, further including a body having a wall portion positioned adjacent to the window and defining a fluid chamber as the object to be heated with the heat being supplied thereto through the window.

42. The integrated heater of claim 24 wherein the gate electrode is metal.

43. The integrated heater of claim 24 wherein the object to be heated is a fluid.